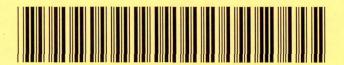
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Site Name

BURLINGTON INDUSTRIES

DocumentType

Site Assessment Rpt (SAR)

RptSegment

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Division

WASTE MANAGEMENT

Section

SUPERFUND

Program

IHS (IHS)

DocCat

FACILITY



ENV. MANAGEMENT FAYETTEVILLE REG. OFFICE

Phase I Ground Water Assessment Burlington Industries, Inc. Raeford Facility Raeford, North Carolina

February 1, 1991

Prepared For

Burlington Industries, Inc. Clarksville, Virginia

Prepared By

Aquaterra, Inc. Charlotte, North Carolina



February 1, 1991

Burlington Industries, Inc. Post Office Box 788 Clarksville, Virginia 23927

Attention:

Mr. Michael Garlick Division Engineering

Reference:

Phase I Ground Water Assessment Results

Raeford Facility

Raeford, North Carolina Aquaterra Job No. C467

Dear Mr. Garlick:

Aquaterra, Inc. (Aquaterra) has conducted the authorized Phase I ground water assessment at the Burlington Industries, Inc. facility located in Raeford, North Carolina. The attached report summarizes our field activities, the laboratory analytical data, and presents our conclusions and recommendations.

The additional site assessment activities included installing one shallow ground water monitoring well at each of two former underground storage tank (UST) areas and two shallow ground water monitoring wells topographically downgradient from each of the former excavation pits. Subsequent to their installation, the monitoring wells at the tank pits were developed and sampled to determine the shallow ground water quality at the two UST sites. A rising head hydraulic conductivity test was also conducted on four wells to determine the approximate shallow ground water seepage velocity across the site. The wells were surveyed for vertical and horizontal control, and static water levels were collected to determine the general ground water flow direction at the site.

If you have any questions, please contact us at (704) 525-8680.

Sincerely, AQUATERRA, INC.

Thomas A. Proctor

Charlotte Branch Manager

Peer Review

Bryson D. Trexler, Jr., Ph.D., P.C. M Senior Project Manager

TAP/tap R164-91C

Phase I Ground Water Assessment Burlington Industries, Inc. Raeford Facility Raeford, North Carolina February 1, 1991

1 Introduction

Aquaterra, Inc. (Aquaterra) has conducted a Phase I ground water assessment at the Burlington Industries, Inc. (Burlington) facility located in Raeford, North Carolina (see Figures 1 and 2). Previous activities at the site included removing six petroleum underground storage tanks (USTs) and the subsequent assessment of the pit bottom soils. These activities are detailed in two Aquaterra reports dated April 2 and April 4, 1990 and entitled *Underground Storage Tank Closure Assessment*.

The limited ground water assessment was initiated due to the elevated petroleum contamination levels detected in the soil samples collected during the excavation of two of the six UST systems. As documented in the April 2, 1990 report, 180 mg/Kg of total petroleum hydrocarbons (TPH), identified as Varsol, was detected in a pit bottom soil sample collected below the 1,000 gallon mineral spirits UST. As documented in the April 4, 1990 report, 17 and 22 mg/Kg of TPH, also identified as Varsol, were detected in two pit bottom soil samples collected below the 1,000 gallon Varsol UST. The apparent shallow ground water table was encountered during the excavation and soil removal of the Varsol UST, indicating that shallow ground water may have been impacted by the release.

Based upon the field assessment activities and laboratory analytical results from the UST removal assessments, the implementing agency, the North Carolina Department of Environment, Health, and Natural Resources (DEHNR) requested that Burlington perform an assessment of the potential impact to the ground water beneath the former UST sites. This request was made in a June 6, 1990 correspondence from DEHNR, as shown in Attachment A.

2 Ground Water Assessment

2.1 Monitoring Well Installation

Prior to installing the monitoring wells, Aquaterra applied for and received a Monitoring Well Construction Permit, as required by the State of North Carolina (see Attachment B).

On November 7 and 8, 1990, an Aquaterra geologist supervised the installation of six monitoring wells (MW-1 through MW-6, see Figure 3). The monitoring wells were installed utilizing an auger rig supplied by Carolina Drilling Company of Wilmington, North Carolina. An 8-inch boring was advanced to approximately 15 feet below the ground surface at each well location. During the boring, split spoon samples and cuttings were scanned for emissions of volatilized organic compounds (VOCs) with an organic vapor analyzer (OVA) (see Table 1). The split spoon samples, collected at 5-foot intervals, and the drill cuttings were logged in the field according to the

Unified Soil Classification System (ASTM D-2488). A boring log for each monitoring well is in Attachment C.

Upon termination of the borings, a ground water monitoring well was constructed by installing a 2-inch diameter PVC casing and screen. The annulus was backfilled with filter sand to approximately 1 to 2 feet above the screen, and a 1-foot hydrated bentonite seal was emplaced above the filter pack. The wells were installed with a water tight cap protected by a lockable steel cover and lock. Details of the construction of each monitoring well can be found in the well construction schematics and Well Construction Records (see Attachment C). Upon completion of the monitoring wells, the shallow ground water was allowed to equilibrate. The depth to the static ground water level was then measured with an electric water level probe (see Table 2).

2.2 Surveying and Ground Water Flow Direction

The monitoring wells were surveyed by Aquaterra personnel for vertical and horizontal control. These data and the depth to water measurements in each well have been used to calculate the static water level elevation at each well location (see Table 2). From this elevation, a ground water direction map has been constructed for the shallow ground water in the vicinity of each UST system (see Figures 4 and 5). As shown, the shallow ground water is migrating in a northwesterly direction at the former Varsol UST pit and north, northeasterly direction at the mineral spirits UST.

2.3 Aquifer Parameter Determinations

Aquaterra conducted a rising head hydraulic conductivity test on monitoring wells MW-1, MW-3, MW-4, and MW-6 to determine the approximate hydraulic conductivity of the aquifer in the immediate vicinity of the wells. The test consists of bailing a measured volume of water from the well and then measuring the rate of ground water recovery. Using the methods discussed in *Field Permeability Test Methods with Applications to Solution Mining*, published by the U.S. Bureau of Mines (PB-272 452, August 1977), the hydraulic conductivity of the screened interval at the four well locations are:

Well Number	Hydraulic Conductivity (cm/sec)
MW-1	2.66 x 10 ⁻⁴ 4.90 x 10 ⁻⁴ 4.84 x 10 ⁻⁴ 6.73 x 10 ⁻⁴
MW-3	4.90×10^{-4}
MW-4	4.84×10^{-4}
MW-6	6.73×10^{-4}

The average hydraulic conductivity at the site is 4.78×10^{-4} cm/sec. The recovery data and the subsequent hydraulic conductivity calculations are contained in Attachment D.

The two shallow ground water contour maps (Figures 4 and 5) were used to determine an average ground water surface gradient. At the Raeford site, the

hydraulic gradient is approximately 1.75 feet of vertical drop per 125 horizontal feet (or a gradient of 0.01415 foot per foot). An effective porosity of the soils has been estimated at approximately 20 percent, which is fairly typical and representative of the soils in the area. Based upon these data and assumptions, as well as the calculated hydraulic conductivities, an average ground water seepage velocity is calculated using a modified form of Darcy's Law, as seen below:

$$v = \frac{Ki}{n}$$

where

v = seepage velocity

K = hydraulic conductivity (4.78 x 10⁻⁴ cm/sec) i = ground water surface gradient (0.01415 ft/ft)

n = effective porosity (20%)

Based on this calculation, the shallow ground water in the vicinity of the facility is migrating at a rate of approximately 8.9 feet per year. This value should be recognized as an average value for the study area. Actual seepage velocities in the hydrogeologic unit are likely to vary due to heterogeneities in the aquifer.

2.4 Ground Water Sampling and Analysis

2.4.1 Ground Water Sampling

Prior to sampling, monitoring wells MW-3 and MW-5 were developed to remove fine particles and silt by purging approximately 5 well volumes of water or purging to dryness. Development was achieved using a separate decontaminated Teflon bailer attached to a new nylon string. After development, the bailer was suspended in its respective well, and the ground water was allowed to recover into the bailer.

After the two wells had recovered from development, the bailer was used to collect ground water samples for analysis. A sample portion from each bailer was decanted into laboratory provided glassware and was labeled with the sample number, date, time, method of collection, analysis to be conducted, sampler's name and remarks. Each sample was placed in a cooler with ice, and chilled to approximately 4°C. Samples were transported to the analytical laboratory using EPA approved chain-of-custody procedures.

2.4.2 Ground Water Sample Analysis

The sample from MW-3, located at the former Varsol UST, was relinquished to laboratory personnel with date, time and signature recorded to be analyzed for Class II Petroleum Products. The analysis includes EPA Method 625, gas chromatography/mass spectrometry (GC/MS) for semivolatile organic compounds (SVOCs) plus a library search. The sample from MW-5, located at the former mineral spirits UST, was analyzed for SVOCs and volatile organic compounds according to EPA Method 601. The EPA Method 625 analysis is recommended by the implementing agency for petroleum contaminated ground water. The EPA

Method 601 analysis was recommended by the DEHNR Regional Office personnel for the well by the former mineral spirits UST.

2.4.3 Ground Water Sample Results

The laboratory analytical results for the ground water sampling are summarized in Table 3 and are documented in Attachment E. Neither MW-3 nor MW-5 exhibited any concentration of a primary analytical compound in excess of the laboratory quantitation limit for EPA Method 625 with a library search. MW-3 exhibited varying concentrations of ten tentatively identified compounds (TICs) and a total concentration of 70 ug/L of TICs. MW-5 exhibited 61 ug/L of four TICs. MW-5, located at the former mineral spirits UST, was also analyzed for VOCs according to EPA Method 601 and exhibited 3 ug/L of 1,1-dichloroethane.

3 Conclusions

Aquaterra has installed six shallow ground water monitoring wells at the site, one at the downgradient edge of each former UST pit and one well topographically downgradient of the site. The monitoring wells at the former UST pits were subsequently developed and sampled to determine the water quality at the site. The monitoring well installation and ground water sampling methods are consistent with the State of North Carolina guidelines for assessing petroleum contaminated ground water. Based upon the field assessment activities, the laboratory analytical results, and our experiences at similar sites, we conclude the following:

- The shallow ground water at the site is migrating in approximately a northerly direction at a rate of approximately 9 feet per year.
- MW-3, located near the former Varsol UST, exhibited 70 ug/l of TICs, detected by the GC/MS library search. Although none of the compounds have specific ground water quality standards, as promulgated by NCAC Title 15 2L, "substances ... for which no standard is specified shall not be permitted in detectable concentrations in Class GA or Class GSA groundwaters."
- MW-5, located at the former mineral spirits UST, exhibited 61 ug/L of TICs, also detected by the GC/MS library search, and 3 ug/L of 1,1-dichloroethane. The TICs consist of two unknown compounds, one unknown aromatic compound, and one unknown hydrocarbon compound. Like MW-3, none of these compounds have established ground water quality standards.
- As documented in the April 2 and April 4, 1990 Aquaterra closure reports, the residual soil contamination in the two UST pits is limited, since most of the contaminated soil was excavated and stockpiled on the site. Of the four insitu soil samples collected from the mineral spirits UST pit, only one sample (2PB2 with 180 mg/Kg of TPH identified as Varsol) exhibited TPH concentrations in excess of the

DEHNR action level of 10 mg/Kg for soils contaminated by petroleum hydrocarbons. The remaining three samples were either below the laboratory quantitation limit or less than the DEHNR action level. Of the two soil samples collected from the Varsol UST pit, concentrations of TPHs (17 and 22 mg/Kg) were detected. These concentrations are slightly in excess of the DEHNR action level.

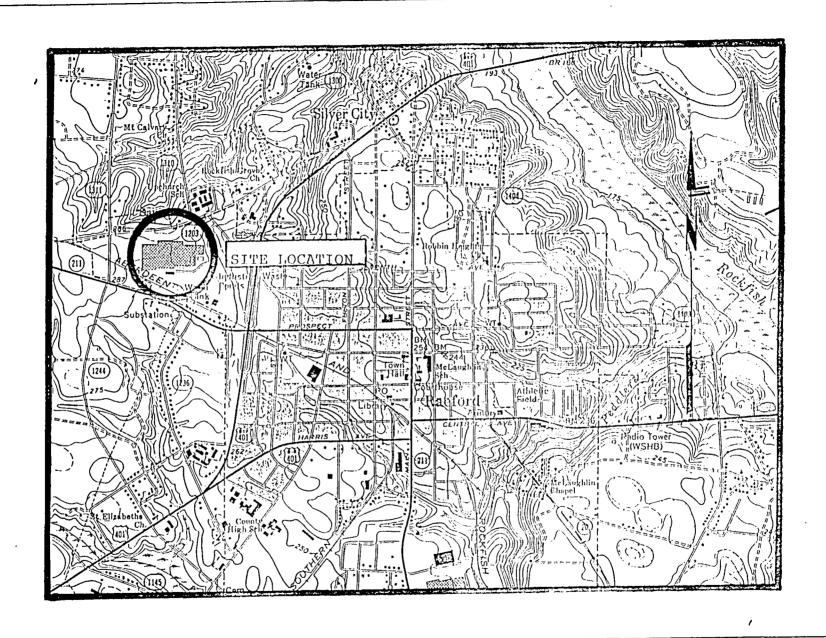
4 Recommendations

Based upon these conclusions, Aquaterra recommends sampling monitoring wells MW-3 and MW-5 for SVOCs and MW-5 for VOCs for two successive quarters. Since the shallow ground water at the site is migrating underneath the building adjacent to the UST sites, additional downgradient wells would be difficult to site and may not effectively monitor the ground water migrating across the UST sites. After sampling the two wells for two additional quarters, we would then recommend evaluating the data and making a decision regarding the quality of the ground water at the site. Dependent upon the results, it may be possible to either close the site to further assessment or to conduct a limited risk assessment in order to determine potential receptors, if any, of the contaminants.

A copy of this report should be forwarded to the DEHNR office located at the following address:

NCDEHNR
Fayetteville Regional Office
Groundwater Section
Wachovia Building, Suite 714
Fayetteville, North Carolina 28301-5043

Attention: Mr. Stephen A. Barnhardt



BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA

TITLE:

SITE LOCATION MAP

JOB: 467C

DRAWING:

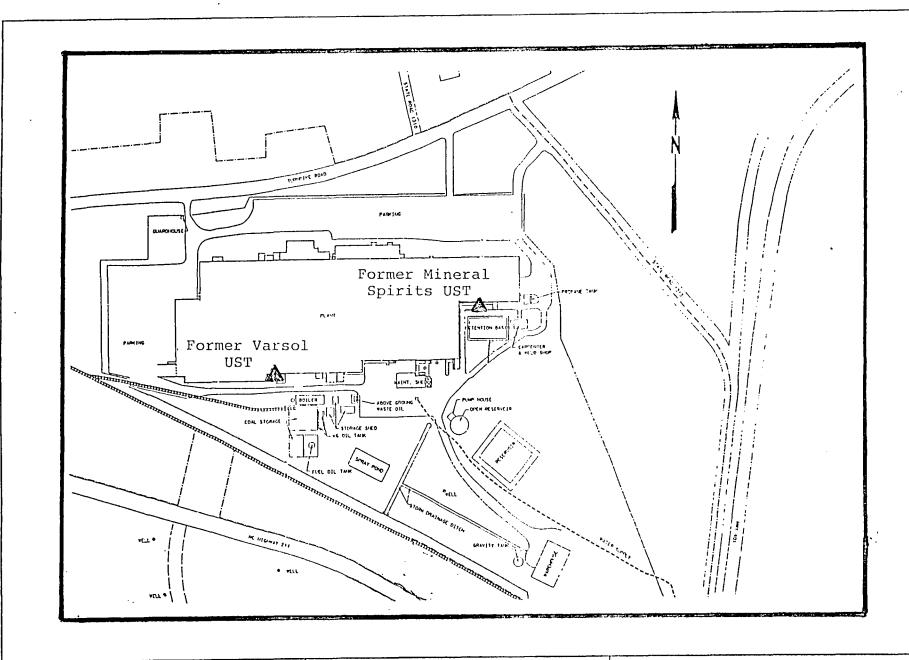
FIGURE:

SCALE: 1"=2000



AQUATERRA, INC.

RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA



BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA

TITLE:

Site Map And UST Locations

^{ЈОВ}: 467С

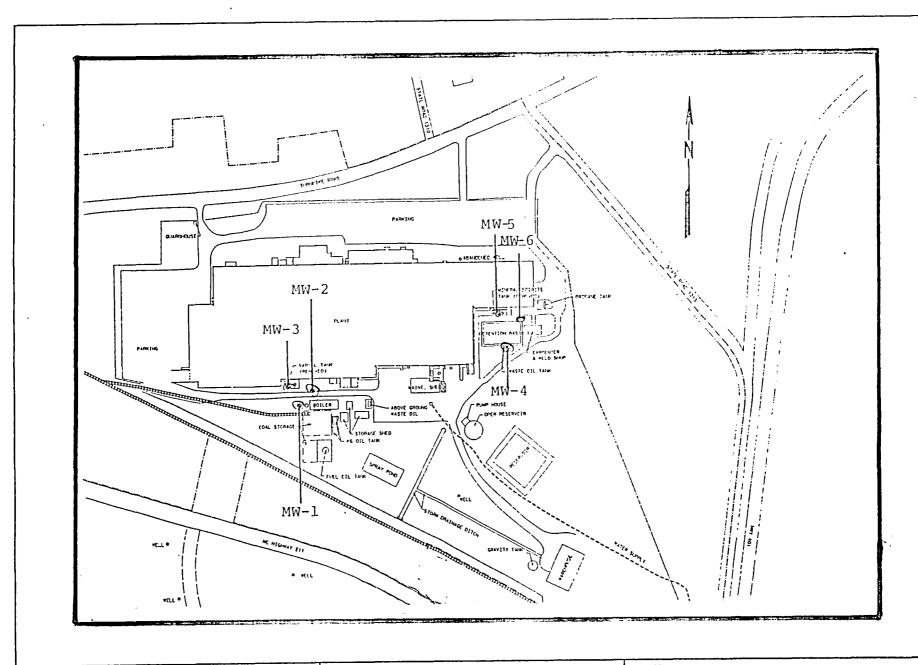
DRAWING:

FIGURE:

SCALE: 1"=400'



AQUATERRA, INC.
RALEIGH, GREENSBORO, CHARLOTTE
NORTH CAROLINA



BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA

TITLE:

MONITOR WELL LOCATION MAP

^{JOB:}467C

DRAWING:

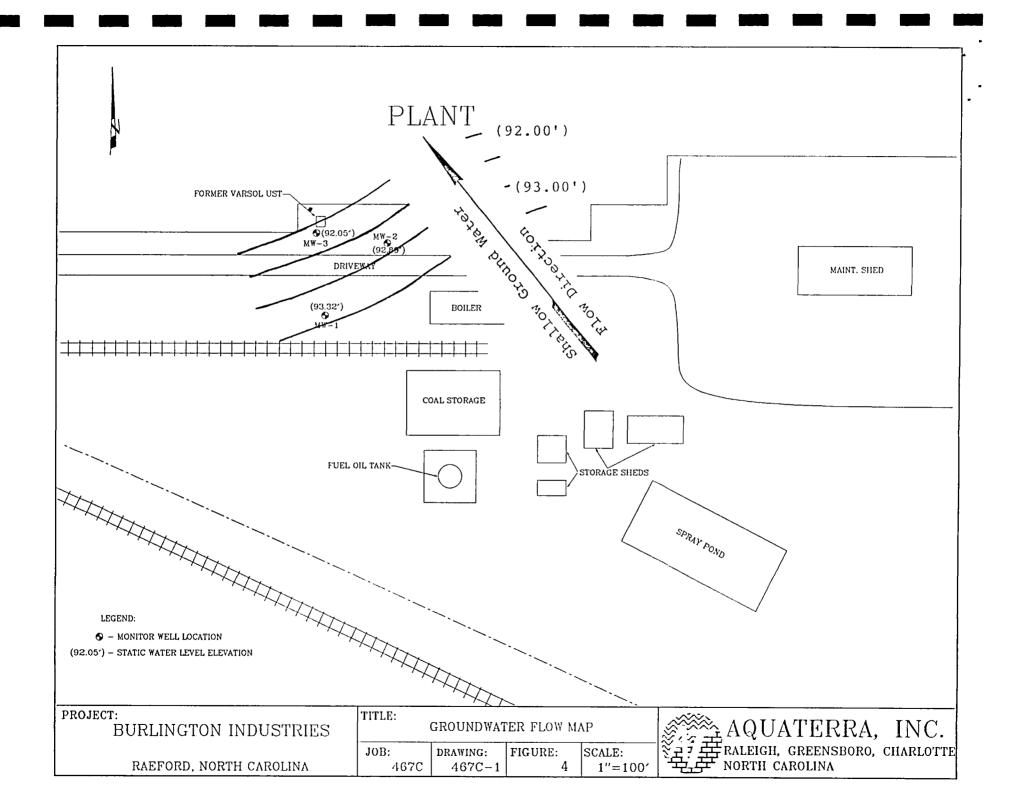
FIGURE:

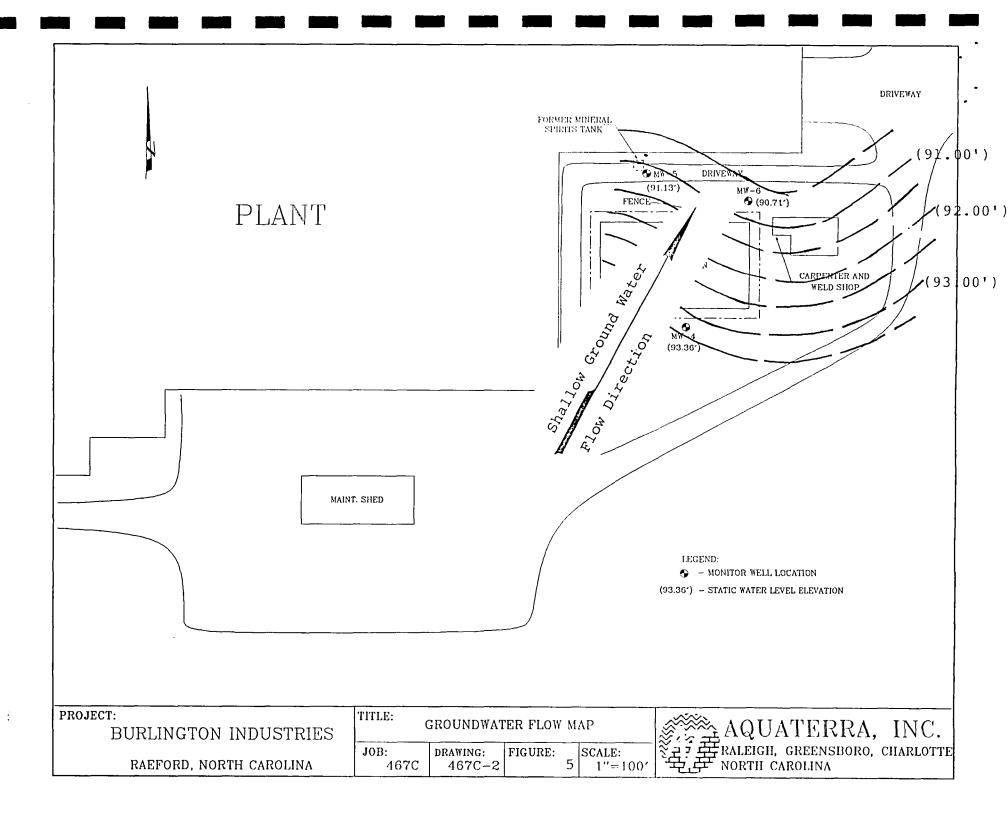
SCALE: 1"=400'



AQUATERRA, INC.

RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA





OVA Results for Monitoring Well Borings Burlington Industries, Raeford Facility Table 1

Monitoring Well	Depth (ft.)	OVA (ppm)	Remarks
MW-1	3.0-4.5	BDL	No odors
	8.0-9.5	BDL	No odors
	13.0-14.5	NA	No odors
MW-2	3.0-4.5	BDL	No odors
	8.0-9.5	NA	Wet, no odors
	13.0-14.5	NA	Wet, no odors
MW-3	5.0	100+	Faint odor
	10.0	NA	Moderate odor
MW-4	3.0-4.5	BDL	No odors
	8.0-9.5	BDL	No odors
	13.0-14.5	NA	Wet, no odors
MW-5	3.0-4.5	BDL	No odors
	8.0-9.5	BDL	No odors
	12,0-13.5	100+	Wet, faint odor
MW-6	2.0-3.5	BDL	No odors
	7.0-8.5	BDL	No odors
	12.0-13.5	BDL	No odors

BDL: Below Detection Limit of 0.1 ppm NA: Sample Not Analyzed

Aquaterra Job No. C467 R164-91C

Table 2 Ground Water Elevation Data, November 9, 1990 Burlington Industries, Raeford Facility

Monitoring Well Number	Top of Casing Elevation(ft.)	Depth to Ground Water(ft.)	Static Water Level Elevation(ft.)
MW-1	98.42	5.10	93.32
MW-2	98.88	5.99	92.89
MW-3	98.52	6.47	92.05
MW-4	99.35	5.99	93.36
MW-5	100.17	9.04	91.13
MW-6	99.26	8.55	90.71

Elevations are referenced to an on-site, temporary benchmark

Aquaterra Job No. C467 R164-91C

Table 3 Ground Water Laboratory Analytical Data Burlington Industries, Raeford Facility

Parameters	MW-3	MW-5	N.C. Ground Water Quality Standard
EPA Method 625 Primary Compounds Total TICS	ND 70 ug/L	ND 61 ug/L	NSE
EPA Method 601 1,1-Dichloroethane	NA	3 ug/L	NSE

TICs Tentatively Identified Compounds are listed in Analytical Results found in Attachment E.

ND None Detected

NSE No Standard Established

NA Not Analyzed

Aquaterra Job No. C467 R164-91C Localeto La Contraction de la

J. Hoyle 3330 L. Nowell B. Archer A. Allen F. Sessons

State of North Carolina Department of Environment, Health, and Natural Resources Fayetteville Regional Office

James G. Martin, Governor

William W. Cobey, Jr., Secretary

DIVISION OF ENVIRONMENTAL MANAGEMENT

June 6, 1990

Mr. Mike Garlick
Burlington Menswear
Executive Offices
P.O. Box 788
Clarksville, Virginia 23927

SUBJECT: Underground Storage Tank Release

Assessment

Burlington Industries Raeford, Hoke County Incident # 5531

Dear Mr. Garlick:

This letter is in response to the Underground Storage Tank removal assessment performed by Aquaterra at Burlington's Raeford and BMD plants located in Raeford, Hoke County. Because of a release of regulated substances into the subsurface environment, the Division requests Burlington Industries to perform an assessment of the potential impact to the groundwater beneath the former UST sites. Please include in the initial phase of this project all appropriate requirements shown in the attached Minimum Information Requirements:

In reference to part five (5) of the above mentioned attachment, the Division requires you submit an application to construct monitor wells, and that monitor well locations and test methods be reviewed and approved by Division personnel prior to the implementation of any site work. Please provide the Division with a plant site map (to scale) showing the location of each former UST site. This or an additional map shall also include all public, industrial, private, domestic and irrigation wells, surface water or other environmentally sensitive features within 1,500' of the former UST sites. The location of proposed monitor wells may be included on this initial base work map. The Division utilizes this information to evaluate your proposed site assessment strategy and will advise you if we feel any proposed actions are inadequate.

Mr. Mike Garlick Page 2 June 6, 1990

Response is requested by July 5, 1990. Please provide an outline of your plan of action with estimated completion dates and the above referenced base map information. If you have any questions, please contact Stephen Barnhardt at (919) 486-1541.

Sincerely,

M. J. Noland, P.E. Regional Supervisor

MJN/SAB/mla

(1) Site Maps w/ times w/ respect to plant site

(2) Proposed plan for well installation of wells

(3) Concered w/ Softey Kleen (Tetrachloroethene)

- wants low quantitation (inst

(4) Sample Safety Kleen well first and then, based upon
the results, the other wells.

(5) Can use a hand anger for wells in liew of a

nig. - Yes

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70 FCJ

MINIMUM INFORMATION REQUIREMENTS FOR REVIEW AND EVALUATION OF REMEDIAL ACTION PLANS AND SUPPORTING SITE CHARACTERIZATIONS

- 1. Map (To scale) showing location of contamination site.
- 2. Discussion of Regional Hydrogeology
 - (a) Information pertaining to local groundwater usage including type of use (public, industrial, private domestic, irrigation, etc.) and identification of aquifer.
 - (b) Identification of all water supply wells within 1500 feet of the source of contamination.
- 3. Map (to scale), showing:
 - (a) Location of source(s) of contamination.
 - (b) Locations of all sampling points, and observation/monitoring wells,
 - (c) Locations of all points of potential exposure to contaminants (water supply wells, surface water bodies, underground utilities, etc.), and
 - (d) Locations of all relevant physical features (buildings, roads, etc.) in the immediate area.
- 4. Direction of Groundwater Flow
 - (a) Static water level measurements from a minimum of three (3) observation wells. Data should include depth to static water level, relative elevations of points from which depth is measured, and date of measurement.
 - (b) Description of methods used for water level measurement including length of time period between well development and water level measurement.
 - (c) Well construction records for all observation wells showing total depth of well, depth of screened interval, date of construction, etc.
 - (d) Identification of significant features or activities which may affect local groundwater flow patterns.
 - (e) Base map showing water level contours indicating direction of groundwater flow.
- 5. Determine area of contamination
 - (a) Identification of the contaminants responsible for violations of

groundwater quality standards.

- (b) Analytical reports for all sampling activities including date of sample collection and references to sampling points shown on base map.
- (c) Description of sampling methods used flushing time, extraction volume, etc.
- (d) Well construction records for all wells utilized as sampling points showing total depth of well, depth of screened interval, date of construction, etc.
- 6. Objectives of The Remedial Action Plan (RAP)
 - (a)—Statement of goals and expected accomplishments of the RAP (eg: source control and/or removal, reduction in contaminant concentrations, removal of "free product", containment or retardation of plume migration, reduction in aerial/vertical extent of contamination, protection of nearby water supplies, etc.).
 - (b) Proposal for establishing target clean-up concentrations based on groundwater quality standards set forth in paragraph .0202 of 15ANCAC 2L and feasibility criteria established under paragraph .0103(e).
- 7. Design and Operation of The Remedial Action System (RAS)
 - (a) Construction details (including design sketches) and facility layout (superimposed on base map) of all components of the remedial action system including recovery wells, interceptor trenches, infiltration galleries, groundwater treatment units, discharge facilities, etc.
 - (b) Operational characteristics and performance standards of all system components (eg: information on recovery wells should include duration of pumping, anticipated yield, and expected radius of influence; data on treatment units should include influent concentrations, expected effluent concentrations, and flow rates). Discussion should address such factors as effectiveness, reliability, maintenance, and safety.
 - (c) Consideration of all permits and approvals required for disposal of waste materials and/or discharge of effluents.
- 8. Follow-up Site Monitoring and Evaluation of RAP
 - (a) Plan for periodic monitoring to detect changes in groundwater movement, plume geometry, and qualitative characteristics of the plume.
 - (b) Plan for continuing re-evaluation of the effectiveness of the RAS including review of performance criteria and site response to pumping activities, disposal of effluent, etc.

FIELDS OF COMPETENCE

- Market development of all phases of Environmental and Geotechnical Services to major national corporations and government agencies
- Client development of Underground Storage Tank Management Programs
- Client development of Asbestos Management Programs
- Strategic market planning
- Over 10 years of professional experience in marketing environmental and geotechnical services

PROFESSIONAL MEMBERSHIPS/AFFILIATIONS

- Professional Construction Estimators Association
- TAPPI
- Society for Marketing Professional Services

EDUCATION

University of North Carolina-Charlotte, B. S., Political Science, 1975

EMPLOYMENT HISTORY

1987 - Present

Responsible for the market development of all phases of Environmental and Geotechnical Engineering Services to major national corporations, government agencies, financial institutions, and developers.

1978 - 1987

Branch Administrator/Marketing Law Engineering Testing Company Charlotte, NC

Responsible for marketing metals testing, underground storage tank testing, environmental engineering and geotechnical services. Duties also included personnel and salary administration, invoicing and review of contracts. Held title of Nuclear Security Administrator and Department of Defense Security Officer.

TARTAN SEARCH ASSOCIATES, INC.

DATE: 1/21/91	2
EDOM: FO THE TOTAL	
FROM: FAITH I BLIGH	d
TO: TOM PROCTOR	
FAX #: 704/527-2792	
NUMBER OF PAGES (with cover):	
Please call 919-553-1020 if all pages are not received.	
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State of North Carolina Department of Environment, Health, and Natural Resources Fayetteville Regional Office

lames G. Martin, Governor

William W. Cobey, Jr., Secretary

DIVISION OF ENVIRONMENTAL MANAGEMENT

August 15, 1990

Mike Garlick
Burlington Ind., Menswear Division
P.O. Box 788
Clarksville, VA 23927

SUBJECT: Well Construction Permit

No. 46-0064-WM-0060

For the Construction of Six (6)
Monitor Wells Located at the
Burlington Industries Facility

Raeford, Hoke County

Sincerely,

No Land, J.E.

Regional Supervisor

Dear Mr. Garlick:

In accordance with your application received August 3, 1990, we are forwarding herewith Well Construction Permit No. 46-0064-WM-0060 dated August 15, 1990 issued to Burlington Ind., Inc., as owner, for the construction of six (6) monitor wells at the subject location.

This Permit will be effective from the date of its issuance and shall be subject to the conditions and limitations as specified therein.

If any parts, requirements, or limitations contained in this Permit are unacceptable to you, you have the right to an adjudicatory hearing before a hearing officer upon written demand to the Director within 30 days following receipt of this Permit, identifying the specific issues to be contended. Unless such demand is made, this Permit shall be final and binding.

MJN/SAB/rhg

Enclosure

cc: Thomas Proctor

AUS 2 0 1990

NORTH CAROLINA

ENVIRONMENTAL MANAGEMENT COMMISSION

RALEIGH, NORTH CAROLINA

PERMIT FOR THE CONSTRUCTION OF A WELL OR WELL SYSTEM

In accordance with the provisions of Article 7, Chapter 87, North Carolina General Statutes, and other applicable Laws, Rules and Regulations.

PERMISSION IS HEREBY GRANTED TO

Burlington Industries, Inc.

FOR THE CONSTRUCTION OF six (6) monitor wells to be completed in the surficial aquifer and located at the Burlington Industries, Inc. facility in Raeford, Hoke County; in accordance with the application dated July 31, 1990 and in conformity with specifications and supporting data, all of which are filed with the Department of Environment, Health and Natural Resources and are considered a part of this Permit.

This Permit is for well construction only, and does not waive any provisions or requirements of the Water Use Act of 1967 or any other applicable laws or regulations.

Construction of a well under this Permit shall be in compliance with the North Carolina Well Construction Regulations and Standards and any other laws and regulations pertaining to well construction.

This Permit will be effective from the date of its issuance through the duration of this project or as this shall be amended, and shall be subject to other specified conditions, limitations, or exceptions as follows:

1. To receive approval for the construction of any additional monitor/recovery wells at the location described above contact:

Division of Environmental management/Groundwater Section Suite 714, Wachovia Bldg. Fayetteville, NC (919) 486-1541

Copies of construction diagrams for proposed wells and a site plan (map) showing the locations of proposed wells must be provided.

2. Furnish copies of all chemical analyses to the Division of Environmental Management at the above address.

Well Construction Permit No. 46-0064-WM-0060 Page 2

Permit issued this the 15th day of August, 1990

FOR THE CORPHICARCLINA ENVIRONMENTAL MANAGEMENT COMMISSION

M.J. Noland, Regional Supervisor Division of Environmental Management

By Authority of the Environmental Management Commission

Permit No. 46-0064-WM-0060

!

-1 <u>0=</u> 1H	CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (\$19) 733-5083	
	WELL CONSTRUCTION RECORD	

	FOR OFFICE USE ONLY
Ouad. No	Serial No
	Long Pc
Minor Basin _	
Basin Code _	
Header Ent	GW-1 Ent

WELL CO	DNSTRUC	TION	RECORD
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	_		
LING CONTRACTORCarolina Drilling			
RILLER REGISTRATION NUMBER	STATE WELL CONSTRUCTION PERMIT NUMBER: 46-0064-WM-0060		
YELL LOCATION: (Show sketch of the location below) MW-1			
Vearest Town: Raeford	County:	Hoke	
State Highways 401 and 211		поле	
Abad, Community, or Subdivision and Lot No.)	Depth	T -	DRILLING LOG
WNER Burlington Industries	From 	To 	Formation Description
DRESS Post Office Box 788			
(Street or Route No.) Clarksville VA 23927			
City or Town State Zip Code			See Attachment A
TE DRILLED 11-7-90 USE OF WELL Monitoring			
TAL DEPTH 18.0 CUTTINGS COLLECTED X Yes No	-		·
ES WELL REPLACE EXISTING WELL? Tes X No			
STATIC WATER LEVEL: 5.10 FT. D above TOP OF CASING,			
TOP OF CASING IS FT. ABOVE LAND SURFACE.			
LD (gpm): N/A METHOD OF TEST N/A			
WATER ZONES (depth): N/A	·		
			
CHLORINATION: Type <u>None</u> Amount			
SING:			
Wall Thickness Depth Diameter or Weight/Ft. Material	II add	ditional sp	ace is needed use back of form.
From Surfaceo 3.0 Ft. 2" Sch.40 PVC	(05		OCATION SKETCH
From To Ft	or other ma		istance from at least two State Roads, ee points)
FromToFt			
EROUT:			
Depth Material Method			
From Surface 1.5 Ft. Portland #1 Pour		See A	ttachment B
From To Ft		DCC A	caciment 5
SCREEN:			
■ Depth Diameter Slot Size Material			•
From 3.0 To 13.0 Ft. 2 in 0.010 in PVC			
From To Ft in in.			
			•
GRAVEL PACK:			
Depth Size Material			·-·
From 2.5 To 18.0 Ft. Coarse Sand			
FromToFt			-
MARKS: Well point length = 0.25'			
I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN FR	ACCORDAN	NCE WITH	15 NCAC 2C. WELL CONSTRUCTION
STANDARDS, AND THAT A GOLD OF THIS RECONDIANS BEEN THE	wern	WELL OW	2/1/9/

SIGNATURE OF CONTRACTOR OR AGENT



AQUATERRA, INC.

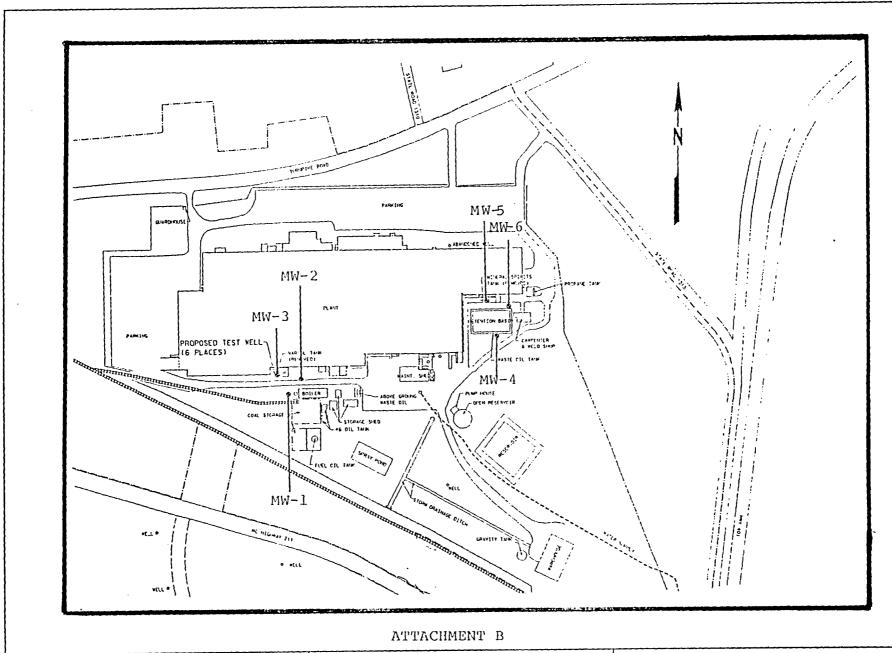
ATTACHMENT A

MW-1

Subsurface Drill Log

-	MM-T		~~~		3
th ()	Surface Elevation SOIL/MATERIAL DESCRIPTION	(PLES	OVA Resu	lts (ppm)	Remarks
Depth (Feet)	SOIL/MATERIAL DESCRIPTION	SAR	SPT. SPOON	CUTTINGS	Remarks
	A. See Below	T	{		No solvent odor
	Brick red silty clay (ML)				·
- 5 -	Light brown to tan silty clay		BDL		No solvent odor spoon 3.5'-5.0' Blows 3-4-5
			BDL		No solvent odor
- 10-	Light gray to cream white sandy silty clay (CL)				Spoon 9.0'-10.5' Blows 3-1-1 Wet soil cuttings @ approximately 10.0' below grade
15					
20	Boring terminated @ 18.0' below grade in light gray to cream white sandy silty clay (CL)	-			
. 25				1	
ŀ	A. Grass, grass roots, dark brown sandy clayey silt (0)	ا (د)			
	BDL-Below OVA detection limit of 0.01 ppm total volatilized organic compounds				

Drilling & Sampling Meets ASTM D-1586 & ASTM D-1587			Page of
Supervisor	Steven M. Burrows	Location _	BI - Raeford, NC
•			11-7-90
Rig Type	Hollow Stem Auger	Date Drilled -	
Weather	Sunny	Job Number -	467C



BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA

TITLE:

MONITOR WELL LOCATION MAP

JOB: 467C

DRAYING:

FIGURE:

SCALE: 1"=400'



AQUATERRA, INC.

RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA

	17
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION	
P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-5083	

WELL	CONST	RUCTION	RECORD

	FOR OFFICE USE ONLY
Ouad. No.	Serial No.
Lat	Long Pc
Minor Basin	
Basin Code	
Header Ent	GW-1 Ent
L	

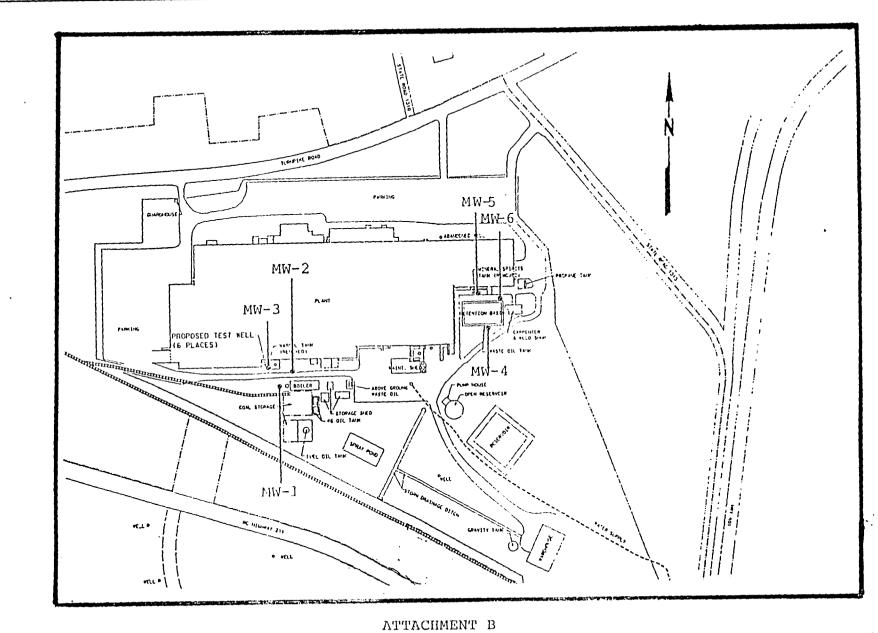
STATE WELL C	ONSTRUCTION R: 46-0064-WM-0060
SOMON TIMES	in,
County: Hok	e
	DRILLING LOG
	Formation Description
	See Attachment A
	•
If additional space is needed use back of form.	
LOCATION SKETCH (Show direction and distance from at least two State Roads	
See Attachment B	
	·
	~ ·
	·
	~
DVIDED TO THE WELL (TH 15 NCAC 2C, WELL CONSTRUCTION DWNER.
	County: Hok Depth From To If additional: (Show direction and or other map refere



	AQUATERRA, INC.		TTACHMENT A	ד ווי רד
ATTAM .	MW-2	<u> 5u</u>	bsurface	Drill Log
oth et)	Surface Elevation	MPLES	OVA Results (ppm)	Remarl

ų Ç	Surface Elevation SOIL/MATERIAL DESCRIPTION	rple3	OVA Results (ppm)		Remarks	
Depth (Feet)	SOIL/MATERIAL DESCRIPTION		SPT. SPOON	CUTTINGS	Remarks	
	A. See Below					
	Black silty clay (CL)			•	no solvent odor	
	Brick red silty clay (ML)					
	Medium brown silty clay (ML)			BDL	no solvent odor	
[·]	Medium biowi biley old; (iii)	-			no solvent odcr	
		-			damp soil cuttings @ approximately 6.0' below grade	
- 10 -	Flesh to tan and cream white to light brown silty sandy clay (CI				no solvent odor wet soil cuttings approximately 10.0' below grade	
- - 15 -	Boring terminated @ 15.0' below grade in flesh to tan and cream white to light brown silty, sandy clay (CL)					
20						
- 25	A. Grass and grass roots, dark brown to black sandy, clayey BDL-Below OVA detection limit of 0.01 ppm total volatilized organic compounds		· · · · · · · · · · · · · · · · · · ·	; ;		

Drilling & Sampling Meets ASTM D-1586 & ASTM D-1587 Page 1 of 1			
Supervisor	Steven M. Burrows	Location	BI - Raeford, NC
•	Hollow Stem Auger	Date Drilled	11-7-90
Rig Type	0		
Weather	Sunny	Job Number	3070



PROJECT:

BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA TITLE:

MONITOR WELL LOCATION MAP

 $^{\rm JOB}\!\dot{a}\,67C$

DRAWING:

FIGURE:

SCALE: 1'' = 400



AQUATERRA, INC. RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA

	CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
I	DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
	P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-5083

WELL	CONS.	TRUCT	LION	REC	ORD

51 Bamead 11/21

	FOR OFFICE USE ONLY
	Serial No.
Minor Basin _	Long Pc
Basin Code _ Header Ent	GW-1 Ent
L	

a limit original to Division of Southermorest Macagament and courte well awalls

ING CONTRACTOR _ Carolina Drilling	STATE WELL CONSTRUCTION
ILLER REGISTRATION NUMBER	PERMIT NUMBER: 46-0064-WM-0060
L LOCATION: (Show sketch of the location below) MW-3	
earest Town: Raeford	County: Hoke
State Highways 401 and 211	Depth DRILLING LOG
ed, Community, or Subdivision and Lot No.)	From To Formation Description
WNER Burlington Industries	
RESS Post Office Box 788	
(Street or Route No.) Clarksville VA 23927	
City or Town State Zip Code	See Attachment A
E DRILLED 11-7-90 USE OF WELL Monitoring	
OTAL DEPTH 15.0' CUTTINGS COLLECTED Yes No	
S WELL REPLACE EXISTING WELL? Yes X No	
TATIC WATER LEVEL: 6.47 FT. 0 2bove TOP OF CASING.	
TOP OF CASING IS 0 FT. ABOVE LAND SURFACE.	
D (gpm): N/A METHOD OF TEST N/A	
ATER ZONES (depth): N/A	
HLORINATION: Type None Amount	
SING:	
Wall Thickness Depth Diameter or Weight/Ft. Material	If additional space is needed use back of form.
From Surface 3.0 Ft. 2" Sch.40 PVC	LOCATION SKETCH
From ToFt(0.19")	(Show direction and distance from at least two State Roads, or other map reference points)
FromToFt	on onto map reference points,
220UT:	
Depth Material Method	
From Surface 1.5 Ft. Portland #1 Pour	
From To Ft	See Attachment B
REEN:	
	,
Depth Diameter Slot Size Material	
From 3.0 To 13.0 Ft. 2 in 0.010 in PVC	
From To Ft in in	
From To Ft in in in.	• •
HAVEL PACK:	
Depth Size Material	٠
From 2.5 to 15.0 Ft. Coarse Sand	
FromToFI	
MARKS: Well point length = 0.25'	
I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED	IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION
STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN FR	TVIDED TO THE WELL OWNER. 2/1/91
SIGNATURE OF CO	ONTRACTOR OR AGENT DATE



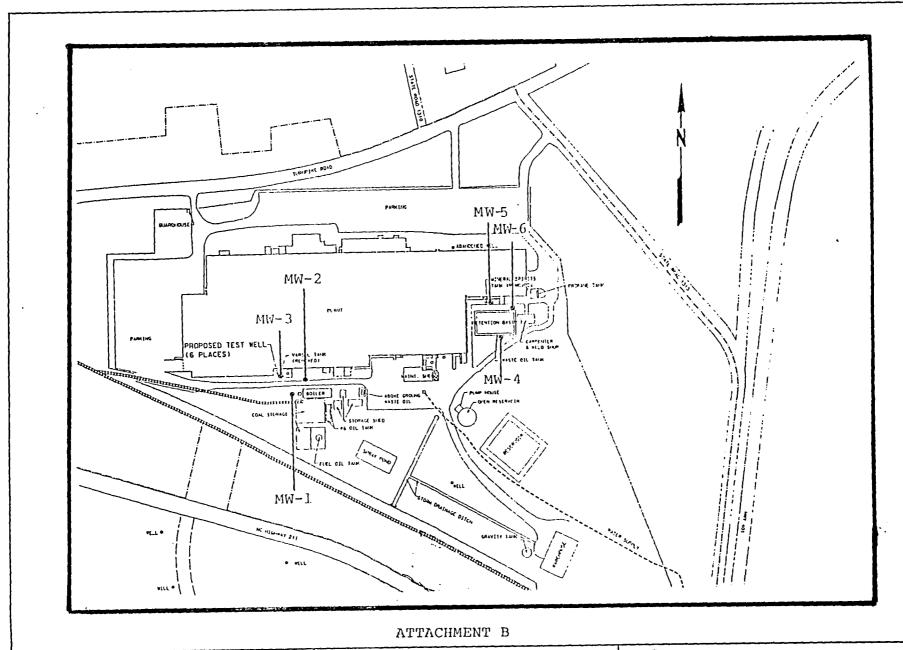
AQUATERRA, INC.

ATTACHMENT A

Subsurface Drill Log

<i>=</i> 🔾	Surface Elevation SOIL/MATERIAL DESCRIPTION	PLES	OVA Resu	lts (ppm)	•
Depth (Feet)	SOIL/MATERIAL DESCRIPTION		SPT. SPOON	CUTTINGS	Remarks
	A. See Below				
	Brick red silty clay (ML)				No solvent odor
= 5	Light brown to cream white silty clay (CL)		100+		Faint solvent
	Light brown to medium brown silty clayey sand (CL)	-			Spoon 5.0'-6.5' Blows 1-1-1
10-	Brick red and light brown silty, sandy, clay (ML)				Moderate solvent odor, waxy
- 15 - 15 20	Boring terminated @ 15.0' below grade in brick red and light brown silty, sandy, clay (ML)				
25	A. Grass, grass roots, light brown, sandy, clayey, silty (OL) BDL-Below OVA detection limit of 0.01 ppm total volatilized organic compounds				

Drilling & S	ampling Meets ASTM D-1586 & ASTM D-156	Page l of l	
Supervisor	Steven M. Burrows	Location	BI - Raeford, NC
Rig Type		Date Drilled	11-7-90
Weather		Job Number	



PROJECT:

BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA

TITLE:

MONITOR WELL LOCATION MAP

JOB: 467C

DRAWING:

FIGURE:

SCALE: 1"=400'



AQUATERRA, INC. RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA

<u>or</u> th <mark>.c</mark> /	AROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
	VISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
	P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-5083

WELL	CONSTRUCTION	RECORD
------	--------------	--------

4-1 Damend 11/04

, , , , , , , , , , , , , , , , , , , 	FOR OFFICE USE ONLY
Ouad. No	Serial No.
Lat	Long Pc
Basin Code	
Header Ent	GW-1 Ent

RILLER REGISTRATION NUMBER 728	STATE WELL CONSTRUCTION PERMIT NUMBER: 46-0064-WM-0060	
Nearest Town: Raeford State Highways 401 and 211 Fead, Community, or Subdivision and Lot No.)	County: Hoke Depth DRILLING LOG From To Formation Description	
Burlington Industries RESS Post Office Box 788 (Street or Route No.) Clarksville VA 23927		
City or Town State Zip Code DEED DRILLED 11-7-90 USE OF WELL MONITORING TOTAL DEPTH 15.0' CUTTINGS COLLECTED Yes No DES WELL REPLACE EXISTING WELL? Yes X No	See Attachment A	4
STATIC WATER LEVEL: 5.99 FT. D above TOP OF CASING. TOP OF CASING IS FT. ABOVE LAND SURFACE. YELD (gpm): N/A METHOD OF TEST N/A		
WATER ZONES (depth): - N/A CHLORINATION: Type None Amount		
Depth Diameter Wall Thickness Material	If additional space is needed use back of form LOCATION SKETCH (Show direction and distance from at least two State or other map reference points)	
Pepth Material Method From SurfaceTo 1.5 FtPortlant #1 Pour From To Ft	- See Attachment B	
Depth Diameter Slot Size Material	- -	
GRAVEL PACK: Depth Size Material	- 	
From To Ft. Coarse Sand From To Ft	-	
I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PHENTED SIGNATURE OF CO		CTION



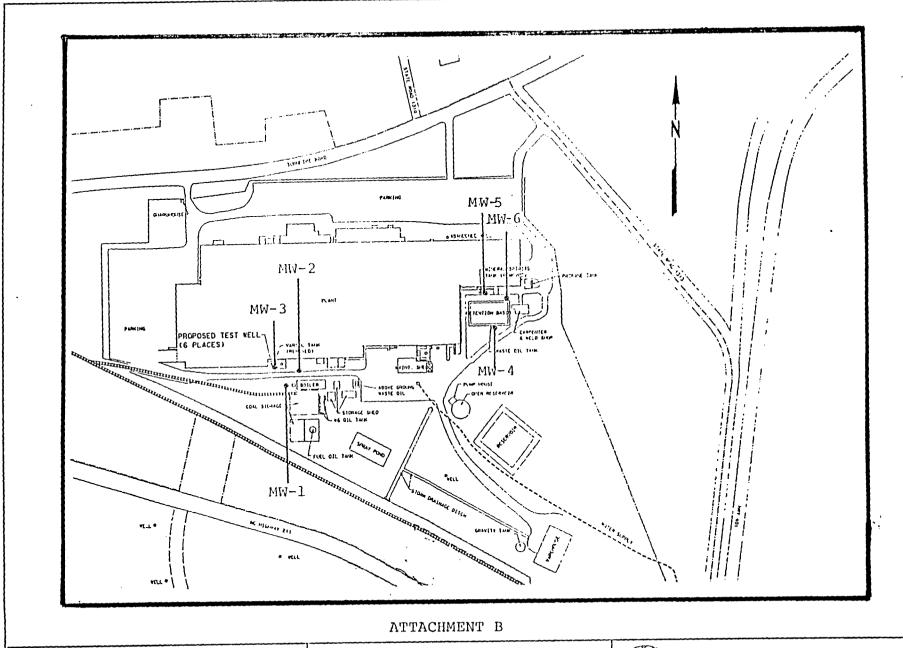
AQUATERRA, INC.

ÄTTACHMENT A

Subsurface Drill Log

						
th ();	Surface Elevation SOIL/MATERIAL DESCRIPTION		OVA Results (ppm)		Remarks	
Depth (Feet)			SPT. SPOON CUTTINGS			
	A. See Below	Ī	1			
	Light brown to tan silty clay				No mineral spirit odor	
5 -	Light brown to cream white	-	BDL		No mineral spirit odor Spoon 3.5'-5.0'	
[]	silty clay (CL)				B	
					Damp soil at approximately 7.0'	
10-	Cream white silty, sandy clay			BDL	No mineral spirit odor	
15 -	White to light tan-cream silty, sandy, fine to medium grain (SM	- 		}	Wet soil at approximately 12.5' No mineral	
	Boring terminated @ 15.0' below grade in white to light tan-cream silty sand, fine to medium grain (SM)	1			spirit odor	
20	-				-	
ŀ						
- 25	-	<i>.</i>				
ŀ		-	·	 .		
-	BDL-Below OVA detection limit of 0.01 ppm total volatilized organic compounds		i.	Ì		

Drilling & S	ampling Meets ASTM D-1586 & ASTM D-158	7	Page of
Supervisor	Steven M. Burrows	Location -	BI - Raeford, NC
Rig Type		Data Drilled	11-7-90
	Sunny	Job Number -	467C
Weather		lop unmber -	



PROJECT:

BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA

TITLE:

MONITOR WELL LOCATION MAP

JOB 467C

DRAWING:

FIGURE: SCALE:

AP | CALE: 1 "= 400 | AQUATERRA, INC. RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA

ORTH	CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
	DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
	P.O. BOX 27687 - RALEIGH, N.C. 27611, PHONE (919) 733-5083

WEL	.L C	ONS	STRU	JCTI	ON	REC	ORD

	FOR OFFICE USE ONLY
Ouad. No	Serial No.
Lat	Long Pc
Basin Code	·
Header Ent	GW-1 Ent

LING CONTRACTOR Carolina Drilling	
ILLER REGISTRATION NUMBER 728	STATE WELL CONSTRUCTION PERMIT NUMBER: 46-0064-WM-0060
LL LOCATION: (Show sketch of the location below) MW-5	.
earest Town: Raeford	County: Hoke
State Highways 401 and 211 ad. Community, or Subdivision and Lot No.)	Depth DRILLING LOG
WNER Burlington Industries	From To Formation Description
DRESS Post Office Box 788	
(Street or Route No.)	
Clarksville VA 23927 City or Town State Zip Code	See Attachment A
TE DRILLED 11-8-90 USE OF WELL Monitoring	
OTAL DEPTH 14 0' CUTTINGS COLLECTED X Yes \ \ \ \ No	
ES WELL REPLACE EXISTING WELL? Yes X No	
TATIC WATER LEVEL: 9.04 FT. D above TOP OF CASING.	
TOP OF CASING IS FT. ABOVE LAND SURFACE.	
LD (gpm): N/A METHOD OF TEST N/A	
ATER ZONES (depth): N/A	
	· · · · · · · · · · · · · · · · · · ·
HLORINATION: Type None Amount	
SING:	If additional space is needed use back of form.
Wall Thickness Depth Diameter or Weight/Ft. Material	
From SurfaceTo 3.75 Ft. 2" Sch.40 PVC	LOCATION SKETCH (Show direction and distance from at least two State Roads.
FromToFt(0.19")	or other map reference points)
From To Ft	
PROUT:	
Depth Material Method	
FromSurfaceTo 2.0 Ft Portland #1 Pour	See Attachment B
From ToFt	
REEN:	
Depth Diameter Slot Size Material	·
From 3.75 To 13.75 Ft. 2 in. 0.01 Qn. PVC	
From To Ft in in	
From To Ft in in in.	•
SRAVEL PACK:	
Depth Size Material	
From 3.0 To 14.0Ft. Coarse Sand	
FromToFt	**
MARKS: Well point length = 0.25'	·
I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED	AN ACCORDANCE WITH 15 NCAC 2C. WELL CONSTRUCTION
STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PART	ONDED TO THE WELL OWNER.
	10 101- 4.11

SIGNATURE OF CONTRACTOR OR AGENT

Submit original to Division of Fourcompany Management and above to well divined

Y-1 Ravised 11/84



AQUATERRA, INC.

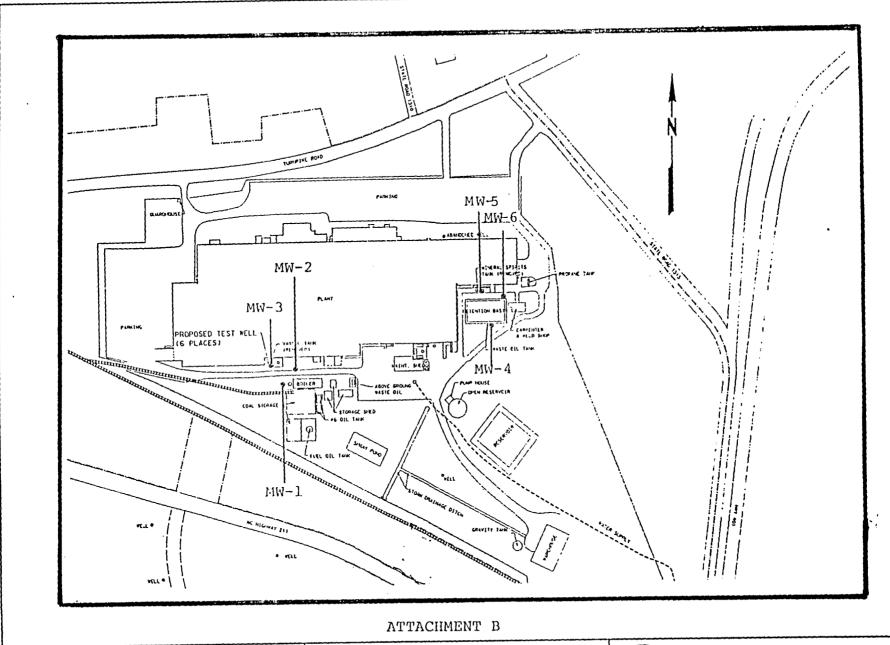
ATTACHMENT A

MW-5

Subsurface Drill Log

oth et)	Surface Elevation SOIL/MATERIAL DESCRIPTION		121		Remarks	
Depth (Feet)		δ	SPT. SPOON	CUTTINGS		
	A. See Below					
	Light to medium brown silty clay (ML)			BDL	No mineral spirit odor	
- 5 -		•			-	
- 10-	Tan, sandy, silty clay (CL)			BDL	Moist soil cuttings at approximately 8.0' No mineral spirit odor	
	Fan clayey, silty fine to medium grain sand (SC)	-		100+	Wet soil cuttings @ approximately l2.0' Faint mineral spirit odor	
15 -	Boring terminated at 14.0' below grade in tan clayey, silty fine to medium grain sand (SC)				spille odol	
- 20 ·						
- 25						
	A. Asphalt and composite stone					
	BDL-Below OVA detection limit of 0.01 ppm total volatilized organic compounds		<u> </u>		+	

Supervisor Steven M. Burrows Location BI - Raeford, NC	Drilling & Sa	ampling Meets ASTM D-1586 & ASTM D-15	587	Page 1 of 1
	Supervisor	Steven M. Burrows	Location -	BI - Raeford, NC
Rig Type HOLLOW Stem Auger Date Drilled 11-8-90	_	Hollow Stem Auger	Date Drilled	11-8-90
Rig Type Hollow Stem Auger Sunny Date Drilled 11-8-90 467C	•	Sunny	Joh Number	467C



PROJECT:

BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA

TITLE:

MONITOR WELL LOCATION MAP

JOB: 467C

DRAWING:

FIGURE:

SCALE: 1"=400



ORTH	CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
	DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
	P.O. BOX 27687 - RALEIGH.N.C. 27611, PHONE (919) 733-5083

W	ELL	CONS	TRU	CTIO	4 REC	ORD
	_					

· ·	FOR OFFICE USE ONLY
Ouad. No	Serial No.
Lat	Long Pc
Basin Code _	
Header Ent	GW-1 Ent

LING CONTRACTORCarolina Drilling	STATE WELL CONSTRUCTION		
TILLER REGISTRATION NUMBER 728	STATE WELL CONSTRUCTION PERMIT NUMBER: 46-0064-WM-0060		
LL LOCATION: (Show sketch of the location below) MW-6			
Vearest Town: Raeford	County: Hoke		
State Highways 401 and 211 Flad, Community, or Subdivision and Lot No.)	Depth DRILLING LOG		
DWNER Burlington Industries	From To Formation Description		
DRESS Post Office Box 788			
(Street or Route No.)			
Clarksville VA 23927 City or Town State Zip Code	See Attachment A		
TE DRILLED 11-8-90 USE OF WELL Monitoring			
OTAL DEPTH 13.5' CUTTINGS COLLECTED X Yes No			
ES WELL REPLACE EXISTING WELL? Yes X No	· · · · · · · · · · · · · · · · · · ·		
STATIC WATER LEVEL: 8.55 FT. Dabove TOP OF CASING,			
TOP OF CASING IS 0 FT. ABOVE LAND SURFACE.			
LD (gpm): N/A METHOD OF TEST N/A			
VATER ZONES (depth): N/A			
The state of the s			
CHLORINATION: Type None Amount	·		
GASING:			
Wall Thickness Depth Diameter or Weight/Ft. Material	If additional space is needed use back of form.		
From Surface 3.0 Ft. 2" Sch.40 PVC	LOCATION SKETCH (Show direction and distance from at least two State Roads.		
FromToFt(0.19")	or other map reference points)		
From ToFt			
GEOUT:			
Depth Material Method			
From Surfaceto 1.5 Ft. Portland #1 Pour	See Attachment B		
From To Ft			
SEREEN:			
Depth Diameter Slot Size Material	•		
From 3.0 To 13.0 Ft. 2 in 0.01 in PVC			
From 3.0 To 13.0 Ft. 2 in 0.01 in PVC			
From To Ft in in			
From To Ft in in.			
From To Ft in in			
From To Ft in in From To Ft in in GRAVEL PACK: Depth Size Material			
From To Ft in in in From To Ft in in GRAVEL PACK: Depth Size Material From 2.5 To 13.5' Ft Coarse Sand			
From To Ft. in. in. From To Ft. in. in. GRAVEL PACK: Depth Size Material From 2.5 To 13.5'Ft. Coarse Sand From To Ft.	-		
From To Ft. in. in. From To Ft. in. in. GRAVEL PACK: Depth Size Material From 2.5 To 13.5'Ft. Coarse Sand	ZIN ACCORDANCE WITH 15 NCAC 2C WELL CONSTRUCTION		



AQUATERRA, INC.

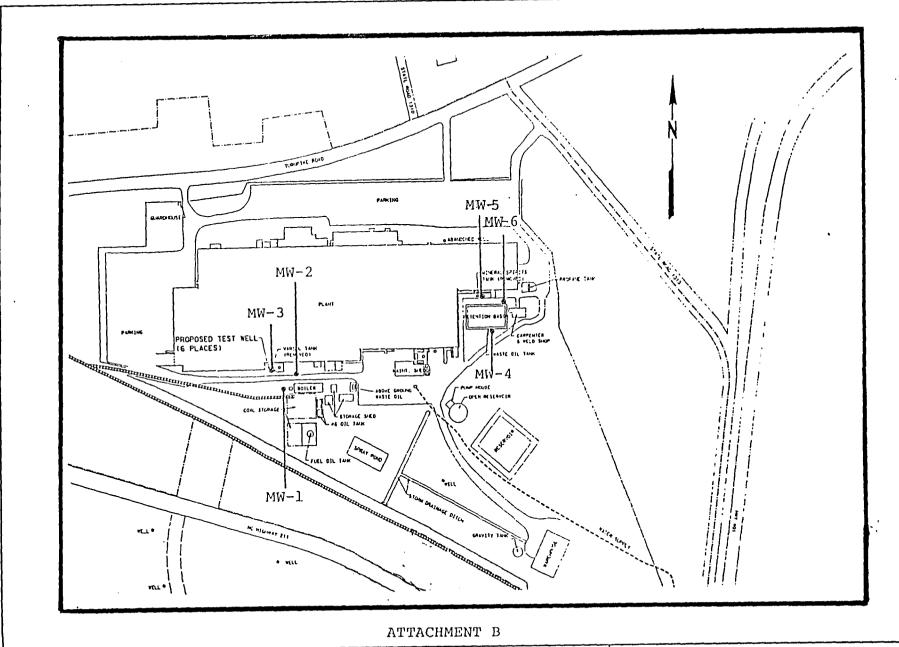
ATTACHMENT A

MW-6

Subsurface Drill Log

ARR	. MW-6	${}$	~ ~ ~ ~ ·		DIIII DOE
4 0	Surface Elevation	PLES	OVA Resu	lts (ppm)	
Depth (Feet)	SOIL/MATERIAL DESCRIPTION	SAM	SPT. SPOON	CUTTINGS	Remarks
	A. See Below	1			
	Tan to light brown silty clay (CL)			. BDL	No mineral spirit odor
5 -	Tan to light brown silty, sandy clay (CL)			BDL	No mineral spirit odor
10-	Brick red to pink sandy, silty clay (ML)			BDL	No mineral spirit odor
	Cream white silty clay (CL) B. See Below	1			
- 15 -	Boring terminated at 13.5' belongrade in cream white silty to fine and medium grain sand (SM)	ŀ	- - - -		_
20		-		-	
- -	A. Grass, grass roots, tan silty clay (OL)		<u> </u>		
25	B. Cream white silty to fine and medium grain sand (SM)			
-	BDL-Below OVA detection limit of 0.01 ppm	-			
	total volatilized organic compounds				

Drilling & S	ampling Meets ASTM D-1586 & ASTM D-158	Page <u>1</u> of <u>1</u>	
Supervisor	Steven M. Burrows	Location .	BI - Raeford, NC
• -			11-8-90
Weather		Job Number	



PROJECT:

BURLINGTON INDUSTRIES RAEFORD, NORTH CAROLINA TITLE:

MONITOR WELL LOCATION MAP

JOB: 467C

DRAWING:

FIGURE:

SCALE: 1'' = 400



AQUATERRA, INC. RALEIGH, GREENSBORO, CHARLOTTE NORTH CAROLINA

Well Number: MW-/

Date: 11-8-90

Computed By: S. Brunes

Casing diameter 2.38'' d = 6.05 (cm)

Borchole diameter $6.5^{"}$ D = 16.51 (cm)

Length of screen 7.90° L = 240.8 (cm)

Time lag at 0.37 H/H_0 T = 240 (seconds)

$$k_{h} = \frac{d^{2} \ln \left[\frac{2mL}{D} \right]}{8 LT}$$
 m = 1

Note: This equation is valid only for a typical monitoring well situation. If the situation differs significantly consult Foundation Engineering Handbook, Winterkorn & Fang, pp. 29-35.

$$K_{h} = \frac{(6.05)^{2} \ln \left[\frac{(2)(1)(240.8)}{.16.51} \right]}{8(240.8)(240)} \frac{1.23 \times 10^{2}}{4.62 \times 10^{5}}$$

Note: $m = \sqrt{\frac{k_{\text{horizontal}}}{k_{\text{vertical}}}}$ Assume $k_h = k_v = 1$

$$k_h = 2.66 \times 10^{-4}$$

X ME>mw-1, 3, 4+6 4.78 410-4

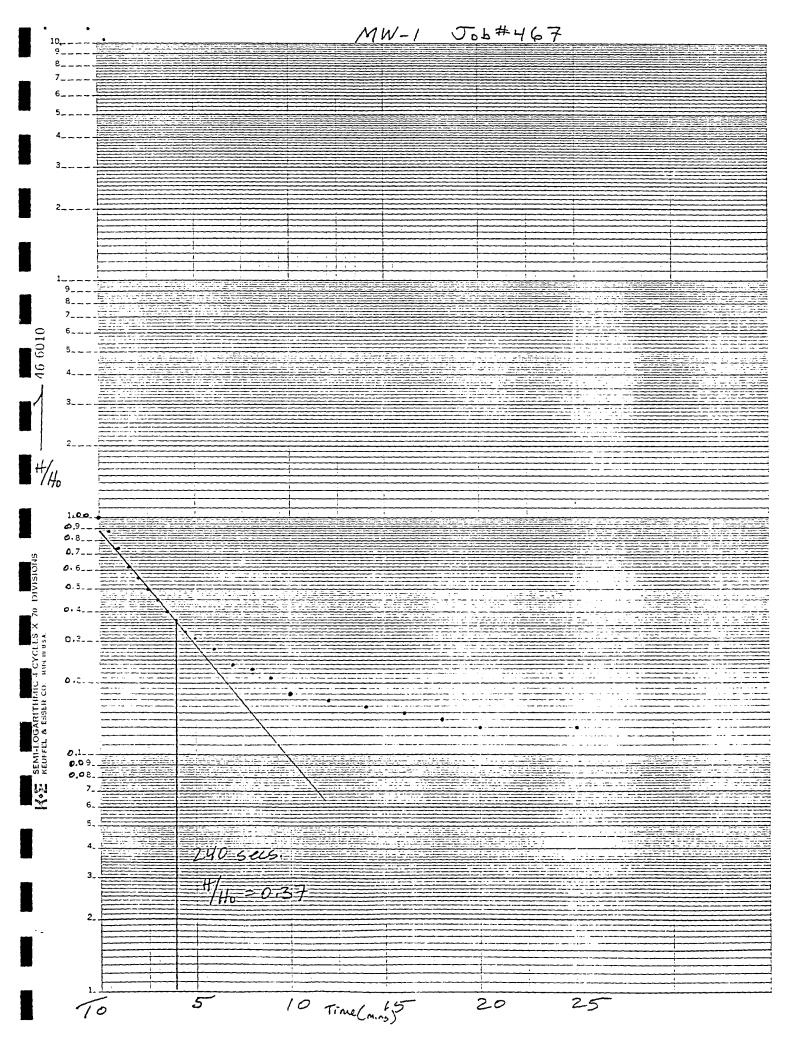
DRAWDOWN TEST

Job Name BI-Rae	Ford Iocation Ractord, NC Job # 467	
	Date 11-8-90 Test Conducted By S. Bunaus	-

WELL INFORMATION

Top of Casing Elevation 98.42	
Casing Diameter 2" Borehole Diameter 6/2	2_ Screen Depth 3.0 - /3.0
Evacuation Method Bailer Amt. Water Removed /	2 gals. Reference Point Toc
RECOVERY DATA	Static H20 @ 5,50' 11-8-90

(mins.) Elapsed Time	(FJTOC) Groundwater Depth	Н	H/H
T.0	7,50	2.00	
1/2	7.25	1.75	0.88
	6.97	1.47	0.74
172	6.74	1.24	0.62
2	6.62	1.12	0.56
21/2	6.50	1,00	0.50
3	6.39	0.89	0.45
31/2	6.30	0.80	0.40
4	6.24	0.74	0.37
41/2	6.16	0.66	2.33
5	6.13	0.63	0.32
6	-6.05	0.55	0.28
2	5.98	0.48	0.24
8	5.96	0.46	0.23
9	5.92	0.42	0.21
10	5.66	0.36	0.18
12	5.63	0.33	0.17
14	5.81	0.31	0.16
	5.79	0.29	0.15
18	5.77	0.27	0.14
20	5.76	0.26	0.13
25	5.75	0.25	0,13
·			



Well Number: <u>MW-3</u>

Date: 11-8-90
Computed By: S. Burrow

Casing diameter 2.38" d = 6.05 (cm)

Borehole diameter 6.5'' D = 16.51 (cm)

Length of screen 6.53' L = 199.03 (cm)

Time lag at 0.37 H/H_o T = 150 (seconds)

$$k_{h} = \frac{d^{2} \ln \left[\frac{2mL}{D} \right]}{8 LT}$$
 m = 1

This equation is valid only for a typical monitoring well situation. Note: situation differs significantly consult Foundation Engineering Handbook, Winterkorn & Fang, pp. 29-35.

(

$$k_{h} = \frac{(6.05)^{2} \left(\frac{(2)(1)(199.03)}{16.51} \right)}{(8)(199.03)(150)} \frac{1.17 \times 10^{2}}{2.39 \times 105}$$

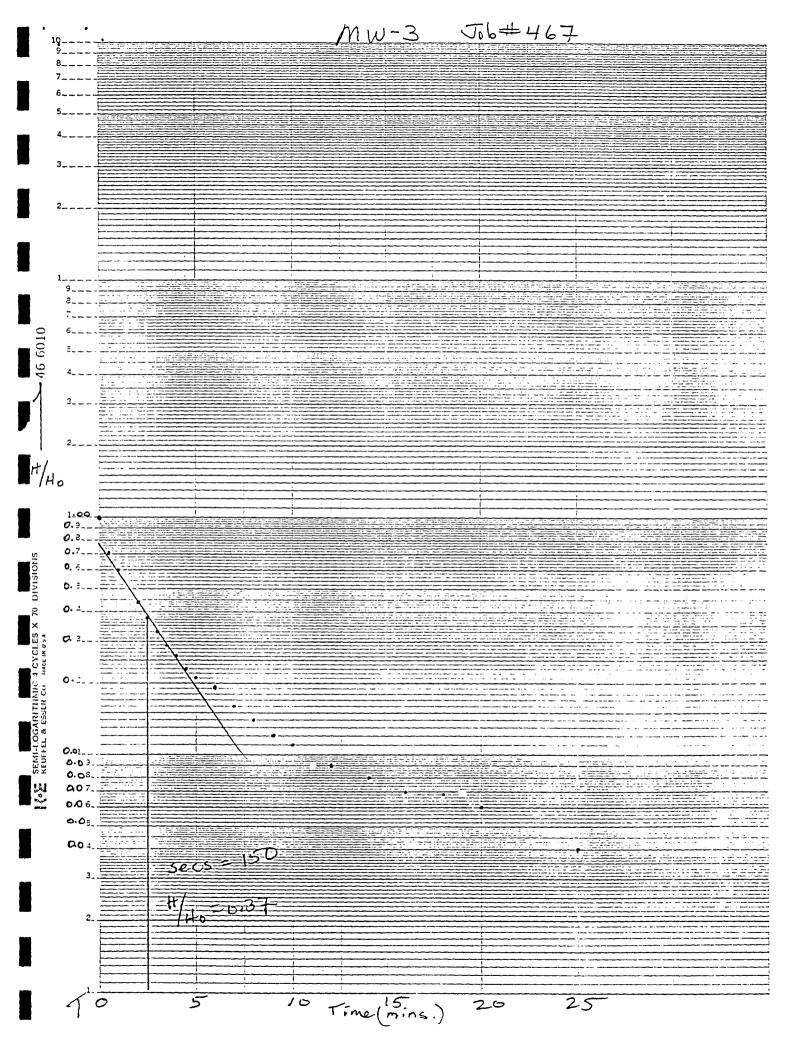
Note:

Assume $k_h = k_v = 1$

$$k_h = 4.90 \times 10^{-4}$$

DRAWDOWN TEST

-	•			·	
Job Name BI-Ro	reford location K	aeford,	HC JOB	<u># 467</u>	
	-3 Date //-8-90 Tes	•			>
	WELL INFORMATION	<u>!</u> .			
Mon of Casing Elevat	tion 98.52	• -			
	" Borehole Diameter_	(1/ //			
·					_
Evacuation Method [Bailer Amt. Water Remoi	red 12 gals			
	RECOVERY DATA		Static H	2008.42	11-8.96
(mins.) Elapsed Time	Groundwater Depth	н	** /* *		
Clapsed Time			H/H		
10	10.74	2.32	/.00		
/2	<u>10.07</u> 9.80	1.38	0.71		. •
11/2	missed	7.36	~	•	
2	9.45	1.03	0.44	•	•
272		 	3		
3			3	•	
31/2	RT	Ractor	7		
Ч	D-+	Nactor	A :		
4/2		Z, , ,	3 2		
- 5		767	<u> </u>		
7			/ 1		
8	\le		2		
9		" of U	/ <u> </u>		
. 10			<u>-</u>		•
12			9		•
14	8.60	0.18	0.08		
16	8.59	0.17	0.07		
18	9.58	0.16	0.07		- · ·
. <u>20</u> 25	8.56 8.53	0.14	0.06		
45	<u>(0,2,5</u>	0.11	0.05	1	
		+		1	
:	•	 		1	
		1	1.	1	



Well Number: MW-H

Computed By:

Borehole diameter
$$6.5''$$
 D = $16.5/$ (cm)

Length of screen
$$7.01' L = 213.67$$
 (cm)

Time lag at 0.37
$$\dot{H}/H_0$$
 $T = /44$ (seconds)

$$k_{h} = \frac{d^{2} \ln \left[\frac{2mL}{D} \right]}{8 LT} \qquad m = 1$$

This equation is valid only for a typical monitoring well situation. Note: situation differs significantly consult Foundation Engineering Handbook, Winterkorn & Fang, pp. 29-35.

1

$$K_{h} = \frac{(6.05)^{2} \int_{h} \left[\frac{(2)(1)(213.67)}{.16.51} \right]}{(8)(213.67)(144)} \frac{1.19 \times 10^{2}}{2.46 \times 105}$$

Note:

m =
$$\sqrt{\frac{k_{horizontal}}{k_{vertical}}}$$

Assume
$$k_h = k_v = 1$$

DRAWDOWN TEST

Job Name_	BI-Rust	ford ia	cation Raes	ford, NC	Job # 467	
				•	Bunas	

WELL INFORMATION

Top of Casing Elevation 99.35

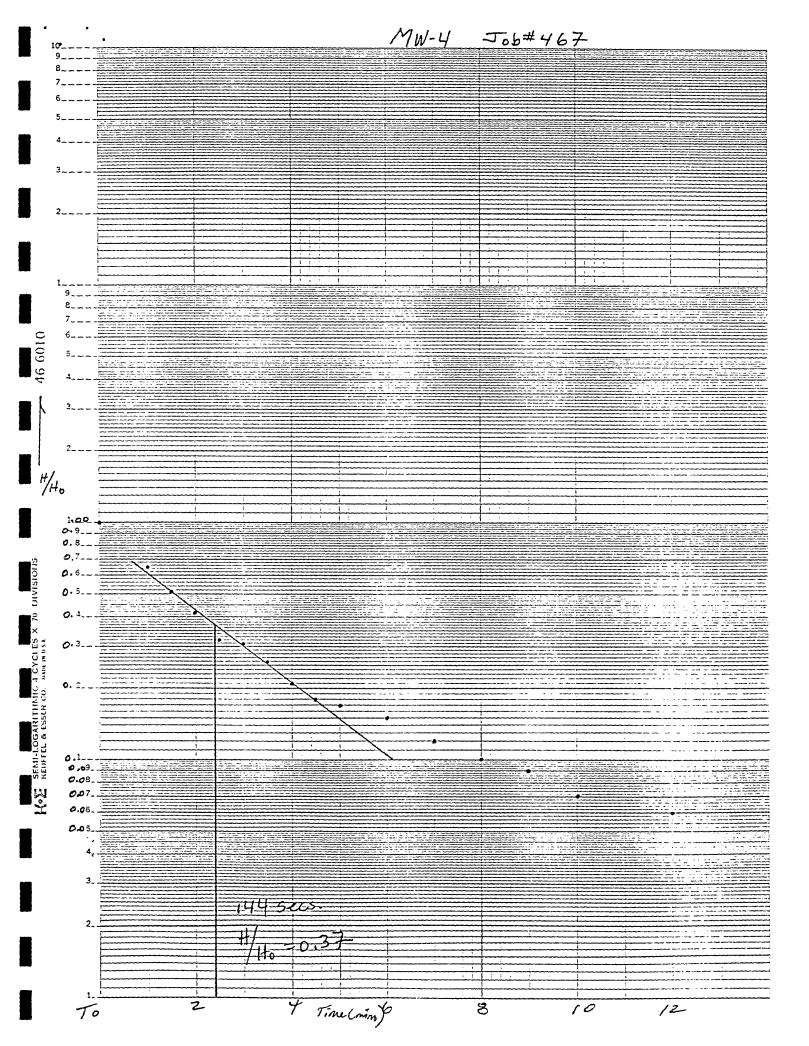
Casing Diameter 2" Borehole Diameter 6/2" Screen Depth 3.0 - 13.0

Evacuation Method Builer Amt. Water Removed 12gals. Reference Point Toc

RECOVERY DATA

Stadic H-20C 5.99' 11-9-90

Elapsed Time	Groundwater Depth	Н	H/H
To	7:43	1.44	
12	missedoms		
1	6.92	0.93	0.65
1/2	6.72	0.73	0.51
2	6.59	0.60	0,42
21/2	6.48	0,49	0.34
3.	6.45	0.46	0.32
31/2	6.36	0.37	0.26
4	6.30	0.31	0.22
41/2	6.25	0.26	0.18
5	6.23	0.24	0.17
5	6.20	0.21	0.15
チ	6.16	0.17	0.12
8	6.14	0.15	0.10
9	6.12	0.13	0.09
.10	6.09	0.10	0.07
12	6.07	0.08	0.06
		<u> </u>	
	·		
·	·		
	•		



Well Number: MW-6

Date: 11-9-90
Computed By: S. Burrans

Casing diameter 2.38" d = 6.05 (cm)

Borehole diameter 6.5'' D = 16.51 (cm)

Length of screen 4.45' L = 135.64 (cm)

Time lag at 0.37 H/H $_{0}$ T = $\frac{/4}{}$ (seconds)

$$k_{h} = \frac{d^{2} \ln \left[\frac{2mL}{D} \right]}{8 LT}$$
 m = 1

This equation is valid only for a typical monitoring well situation. If the Note: situation differs significantly consult Foundation Engineering Handbook, Winterkorn & Fang, pp. 29-35.

$$K_{h} = \frac{(6.05)^{2} \int_{h} \frac{(2)(1)(135.64)}{(16.51)} \frac{1.03 \times 10^{2}}{1.53 \times 10^{5}}$$
(8)(135.64)(141)

Note:

$$m = \sqrt{\frac{k_{\text{horizontal}}}{k_{\text{vertical}}}}$$
 Assume $k_{\text{h}} = k_{\text{v}} = 1$

.000673

30.48 CM = 12" = 1 FOOT

= 21, 223.7 cm/year

= 696.3 FT/4EAY

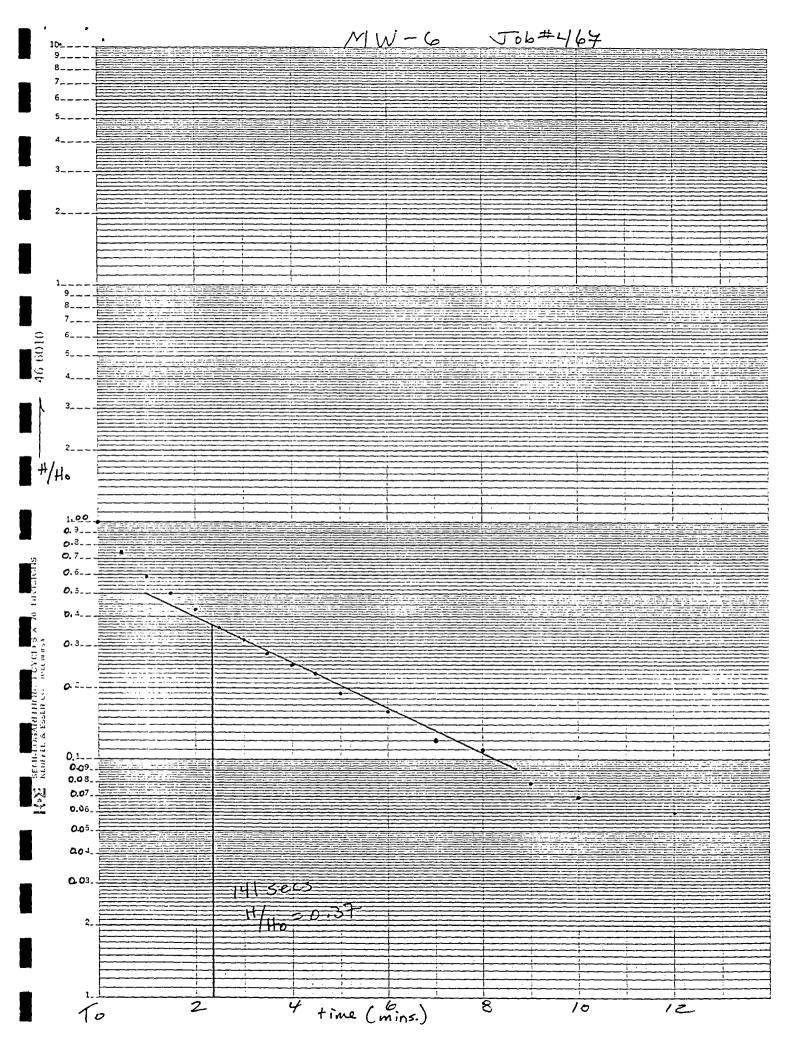
DRAWDOWN TEST

Job Name BI-Racford Iocation Ralford, NC Job # 467 Well Number MW-6 Date 11-9-90 Test Conducted By S. Bernan

WELL INFORMATION

Top of Casing Elevation 99.26
Casing Diameter 2" Borehole Diameter 6/2" Screen Depth 3.0'-13.0'
Evacuation Method Bailer Amt. Water Removed 1299/s Reference Point TOC
Static H20 @ 8.55' 11-9-90

(mins.) Elapsed Time	(ff. ToC) Groundwater Depth	н	H/H
To	9.75	1.20	1.00
1/2	9.45	0.90	0.75
	9.26	0.71	0.59
1/2	9.15	0.60	0.50
2	7.06	0.51	0.43
21/2	8.98	0.43	0.36
3	ତୃ.93	0.38	0.32
.31/2	හි.මව	0.33	0.28
4	28.8	0.30	0.25
4/2	ଚ.୫3	0.28	0.23
5	8.78	0.23	0.19
6	8.74	0.19	0.16
7'	8.69	0.14	0.12
8	8.68	0.13	0.11
9	8.64	0.09	0.08
.10	8:63	0.08	0.07
12	8.62	0.07	0.06
	· · · · · · · · · · · · · · · · · · ·		
·			<u> </u>
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Industrial & Environmental Analysts, Inc.

P.O. Box 12846

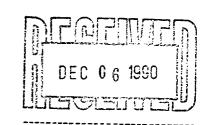
Research Triangle Park, North Carolina 27709

(919) 677-0090

FAX (919) 677-0427

December 4, 1990

Tom Proctor Aquaterra, Inc. 4209-B Stuart Andrew Blvd. Charlotte, NC 28217



Reference IEA Report No.: 794073

Project ID: 467C

Dear Mr. Proctor,

Transmitted herewith are the results of analyses on six samples submitted to our laboratory.

Please see the enclosed reports for your results.

Very truly yours,

INDUSTRIAL & ENVIRONMENTAL ANALYSTS, INC.

Linda F. Mitchell

Director, Technical Support Services

State Certification:

Alabama - #40210

Georgia - #816

Kansas - #E-158

New Jersey - #67719

Tennessee - #00296

Virginia - #00179

South Carolina - #99021

North Carolina - #37720

#84



GC/MS BASE/NEUTRAL EXTRACTABLES EPA 625 COMPOUND LIST

IEA Sample Number: 794-073-3 Sample Identification: MW-3

Date Extracted: 11/14/90

Date Analyzed: 11/28/90 By: Schemmer

		Quantitation	Results
		Limit	Concentration
Number	Compound	(ug/L)	(ug/L)
1	Acenaphthene	5	BQL
2	Acenaphthylene	5	BQL
3	Anthracene	5	BQL
4	Benzo(a)anthracene	5	BQL
5	Benzo(a)pyrene	5	BQL
6	Benzo(b)fluoranthene	5	BQL
7	Benzo(g,h,i)perylene	5	BQL
8	Benzo(k)fluoranthene	5	BQL
9	bis(2-Chloroethoxy)methane	5	BQL
10	bis(2-Chloroethyl)ether	5	BQL
11	bis(2-Chloroisopropyl)ether	5	BQL
12	bis(2-Ethylhexyl)phthalate	5	BQL
13	4-Bromophenyl phenyl ether	5	BQL
14	Benzyl butyl phthalate	5	BQL
15	2-Chloronaphthalene	5	BQL
16	4-Chlorophenyl phenyl ether	5	BQL
17	Chrysene	5	BQL
18	Dibenzo(a,h)anthracene	5	BQL
19	1,2-Dichlorobenzene	5	BQL
20	1,3-Dichlorobenzene	5	BQL
21	1,4-Dichlorobenzene	5	BQL
22	3,3'-Dichlorobenzidine	5	BQL
23	Diethyl phthalate	5	BQL
24	Dimethyl phthalate	5	BQL
25	Di-n-butylphthalate	5	BQL
26	2,4-Dinitrotoluene	5	BQL
27	2,6-Dinitrotoluene	5	BQL
28	Di-n-octylphthalate	5	BQL
29	Fluoranthene	5	BQL
30	Fluorene	5	BQL
31	Hexachlorobenzene	5	BQL
32	Hexachlorobutadiene	5	BQL
33	Hexachlorocyclopentadiene	5	BQL
34	Hexachloroethane	5	BQL
35	Indeno(1,2,3-cd)pyrene	5	BQL
36	Isophorone	5	BQL
37	Naphthalene	5	BQL



GC/MS BASE/NEUTRAL EXTRACTABLES EPA 625 COMPOUND LIST

IEA Sample Number:

794-073-3

Sample Identification: MW-3

Date Extracted:

11/14/90

Date Analyzed:

11/28/90

By: Schemmer

Transaction at

Number	Compound	Quantitation Limit (ug/L)	Results Concentration (ug/L)
38	Nitrobenzene	5	BQL
39	N-Nitroso-di-n-propylamine	5	BQL
40	N-Nitrosodiphenylamine	5	BQL
41	Phenanthrene	5	BQL
42	Pyrene	5	BQL
43	1,2,4-Trichlorobenzene	5	BQL
44	Benzidine	25	BQL
45	N-Nitrosodimethylamine	5	BQL

Comments:

BQL = Below Quantitation Limit



TENTATIVELY IDENTIFIED COMPOUNDS

IEA Sample Number: 794-073-3		
Sample Identification: MW-3		
Applicable Fraction: Volatile	Base/Neutral x Acid O	ther

Tentatively Identified Compound (TIC) refers to substances which are not present in the list of target compounds. Therefore, not all TIC's are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist.

Quantitation is accomplished by relative peak height of the compound compared to that of the nearest internal standard from the total ion chromatogram. TIC's are identified and quantitated only if the peak height is equal to or greater than 10% of that of the nearest internal standard.

TIC Co	ompound Name	Concentration (ug/L)
1	Unknown	5
2	Substituted Cyclohexane	9
3	Isopropylbenzene	6
4	Unknown	7
5	Unknown	11
6	Substituted Cyclopentane	10
7	4-methyl-Decane	5
8	Unknown Aromatic	6
9	Diethylbenzene Isomer	6
10	1-methyl-4-(1-methylethyl)-Benzene	5

Comments:

Not all quantitated results can be accompanied by complete identification. Further investigation should be discussed with your Client Services Representative.



GC/MS BASE/NEUTRAL EXTRACTABLES EPA 625 COMPOUND LIST

IEA Sample Number: 794-073-5

Sample Identification: MW-5
Date Extracted: 11/14/90

Date Analyzed: 11/28/90 By: Schemmer

Number	Compound	Quantitation Limit (ug/L)	Results Concentration (ug/L)
1	Acenaphthene	5	BQL
2	Acenaphthylene	5	BQL
3	Anthracene	5	BQL
4	Benzo(a)anthracene	5	BQL
5	Benzo(a)pyrene	5	BQL
6	Benzo(b)fluoranthene	5	BQL
7	Benzo(g,h,i)perylene	5	BQL
8	Benzo(k)fluoranthene	5	BQL
9	bis(2-Chloroethoxy)methane	5	BQL
10	bis(2-Chloroethyl)ether	5	BQL
11	bis(2-Chloroisopropyl)ether	5	BQL
12	bis(2-Ethylhexyl)phthalate	5	BQL
13	4-Bromophenyl phenyl ether	5	BQL
14	Benzyl butyl phthalate	5	BQL
15	2-Chloronaphthalene	5	BQL
16	4-Chlorophenyl phenyl ether	5	BQL
17	Chrysene	5	BQL
18	Dibenzo(a,h)anthracene	5	BQL
19	1,2-Dichlorobenzene	5	BQL
20	1,3-Dichlorobenzene	5	BQL
21	1,4-Dichlorobenzene	5	BQL
22	3,3'-Dichlorobenzidine	5	BQL
23	Diethyl phthalate	5	BQL
24	Dimethyl phthalate	5	BQL
25	Di-n-butylphthalate	5	BQL
26	2,4-Dinitrotoluene	5	BQL
27	2,6-Dinitrotoluene	5	BQL
28	Di-n-octylphthalate	5	BQL
29	Fluoranthene	5	BQL
30	Fluorene	5	BQL
31	Hexachlorobenzene	5	BQL
32	Hexachlorobutadiene	5	BQL
33	Hexachlorocyclopentadiene	5	BQL
34	Hexachloroethane	5	BQL
35	Indeno(1,2,3-cd)pyrene	5	BQL.
36	Isophorone	5	BQL
37	Naphthalene	5	BQL



GC/MS BASE/NEUTRAL EXTRACTABLES EPA 625 COMPOUND LIST

IEA Sample Number:

794-073-5

Sample Identification: MW-5 Date Extracted:

11/14/90

Date Analyzed:

11/28/90

By: Schemmer

Number	Compound	Quantitation Limit (ug/L)	Results Concentration (ug/L)
38	Nitrobenzene	5	BQL
39	N-Nitroso-di-n-propylamine	5	BQL
40	N-Nitrosodiphenylamine	5	BQL
41	Phenanthrene	5	BQL
42	Pyrene	5	BQL
43	1,2,4-Trichlorobenzene	5	BQL
44	Benzidine	25	BQL
45	N-Nitrosodimethylamine	5	BQL

Comments:

BQL = Below Quantitation Limit



TENTATIVELY IDENTIFIED COMPOUNDS

IEA Sample Number: 794-	-073-5				
Sample Identification:	MW-5				
Applicable Fraction: \	Volatile	Base/Neutral	_x_	Acid	Other

Tentatively Identified Compound (TIC) refers to substances which are not present in the list of target compounds. Therefore, not all TIC's are identified and quantitated using individual standards. TIC listings are prepared utilizing a computerized library search of electron impact mass spectral data and evaluation of the relevant data by a mass spectral data specialist.

Quantitation is accomplished by relative peak height of the compound compared to that of the nearest internal standard from the total ion chromatogram. TIC's are identified and quantitated only if the peak height is equal to or greater than 10% of that of the nearest internal standard.

TIC Compound Name	Concentration (ug/L)
1 Unknown	30
2 Unknown Aromatic	8
3 Unknown Hydrocarbon	14
4 Unknown	Q

Comments:

Not all quantitated results can be accompanied by complete identification. Further investigation should be discussed with your Client Services Representative.



PURGEABLE HALOCARBONS EPA 601 COMPOUND LIST

IEA Sample Number:

794-073-5

Sample Identification: MW-5

Date Analyzed:

11/15/90

By: Averill

Number	Company	Quantitation Limit (ug/L)	Results Concentration (ug/L)		
Number	Compound	(49/11)	(49/11)		
1	Chloromethane	1.0	BQL		
2	Bromomethane	1.0	BQL		
3	Vinyl Chloride	1.0	BQL		
4	Dichlorodifluoromethane	1.0	BQL		
5	Chloroethane	1.0	BQL		
6	Methylene chloride	1.0	BQL		
7	Trichlorofluoromethane	1.0	BQL		
8	1,1-Dichloroethene	1.0	BQL		
9	1,1-Dichloroethane	1.0		3	
10	1,2-Dichloroethene (total)	1.0	BQL		
11	Chloroform	1.0	\mathtt{BQL}		
12	1,2-Dichloroethane	1.0	BQL		
13	1,1,1-Trichloroethane	1.0	BQL		
14	Carbon tetrachloride	1.0	BQL		
15	Bromodichloromethane	1.0	BQL		
16	1,2-Dichloropropane	1.0	BQL		
17	cis-1,3-Dichloropropene	1.0	BQL		
18	Trichloroethene	1.0	BQL		
19	trans-1,3-Dichloropropene	1.0	BQL		
20	1,1,2-Trichloroethane	1.0	BQL		
21	Dibromochloromethane	1.0	BQL		
22	2-Chloroethylvinyl ether	1.0	BQL		
23	Bromoform	1.0	BQL		
24	Tetrachloroethene	1.0	BQL		
25	1,1,2,2-Tetrachloroethane	1.0	BQL		
26	Chlorobenzene	1.0	BQL		
27	1,3-Dichlorobenzene	1.0	BQL		
28	1,2-Dichlorobenzene	1.0	BQL		
29	1,4-Dichlorobenzene	1.0	BQL		

Comments:

BQL = Below Quantitation Limit

PROJ. NO 46 SAMPLERS	FC (Sign)	ROJECT B.	NAM T	ME /	ae fora	<u>.</u>		NO. OF				\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	37		\$	
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